

## MICROSOFT RESPONSE TO FTC REQUEST FOR PUBLIC COMMENT

### I. INTRODUCTION

Microsoft appreciates the opportunity to submit comments in connection with the Federal Trade Commission's ("FTC's") inquiry into cloud computing business practices.<sup>1</sup> Cloud computing represents an innovative and rapidly evolving part of the information technology landscape. By allowing users to rent computing power instead of building their own IT infrastructures, cloud computing services free American enterprises to invest in their ideas, not in server farms, bringing innovations to market faster and at lower costs than ever before. New digital service providers have been able to launch and provide cutting-edge services at massive scale by drawing on cloud computing services. Organizations of all types and sizes are similarly looking to the cloud to reimagine how they can better use cloud native technologies to further their own businesses.

Cloud computing has created new pathways for organizations to optimize their own IT costs by eliminating the need for costly and time-intensive capital expenses and transitioning to more efficient, scalable and performant cloud native technologies. Companies that would have had to build their IT infrastructure on their own can immediately access the multitude of benefits the cloud provides. Cloud computing allows companies of all sizes, from start-ups and early innovators to established enterprises, to scale their capacity as needed in real time and without capital investment. It enables a broad swath of independent software vendors to offer value added services to cloud customers across different infrastructure providers. And it provides organizations with immediate access to cutting-edge technologies and sophisticated cybersecurity capabilities. These advantages of the cloud have led to new growth opportunities across a multitude of industries, from the digital economy to financial services, retailing, manufacturing, healthcare, and beyond. American enterprises, and the consumers they serve, have benefitted from the efficiencies and innovations enabled by the cloud. Microsoft is proud of the contributions it has made as an innovator in cloud computing services.

As the FTC conducts its sector review, we expect the FTC's inquiry will validate three fundamental features of the industry:

First, **cloud computing is highly dynamic and competitive.** The industry has seen an ever-increasing number of new vendors competing for customers with new and evolving needs. Customers consider a wide range of options for how to organize and manage their IT stacks, including potentially running workloads on their own servers, in a private cloud, in a public cloud, or in a hybrid or multi-cloud environment. They choose between cloud services offered by the datacenter provider as well as thousands of solutions provided by ISVs who develop and

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<sup>1</sup> *An Inquiry into Cloud Computing Business Practices: The Federal Trade Commission is Seeking Public Comments*, FTC OFFICE OF TECHNOLOGY (Mar. 22, 2023), <https://www.ftc.gov/policy/advocacy-research/tech-at-ftc/2023/03/inquiry-cloud-computing-business-practices-federal-trade-commission-seeking-public-comments>.

offer their solutions across cloud provider infrastructures. Cloud vendors compete to attract customers along a diverse range of metrics including functionality, scalability, stability, security, access to third-party IaaS and PaaS solutions running on their clouds, and ease of use. Vendors of all types are investing heavily to expand their offerings and to cultivate innovative platforms that can attract and retain customer business.

Second, **cloud customers make sophisticated purchasing decisions when choosing the cloud solutions that best fit their needs.** Customers that consider deploying in the cloud—whether moving part of an existing IT stack to the cloud, creating totally new services, or updating or replacing existing IT workloads—are keenly aware of the alternatives available, and carefully consider the pros and cons of each option. When customers do decide to use (or expand) cloud services, they scrutinize vendors’ offerings to ensure the vendor’s services meet the enterprise’s needs for a particular project, often down to the workload level. Customers who opt to use one cloud vendor for one project can and often do choose to use a different cloud (or a different IT solution) for other parts of their business. Indeed, “multi-cloud” usage is now predominant amongst customers. And these customers tend to make “total cost of ownership” decisions that consider a range of factors including service capabilities, ease of use, and other considerations. Customers negotiate extensively with service providers, including on price, storage capacity, contract length, and more. In combination, this means that for cloud vendors, every project is also a pitch—if a customer is not getting the level of quality or value that it expects from a cloud vendor, that customer is going to turn to other alternatives. Cloud vendors have to compete accordingly.

Third, **security is at the heart of what makes the cloud work.** Without robust security and privacy protections that earn customer trust, public cloud solutions would lack credibility next to other alternatives. A wide range of security features are offered at multiple layers of the cloud stack, and the cloud design that isolates different resources through virtualization means there is no “single point of failure.” The same benefits of scale that drive efficiency and service quality apply in security. While an on-premises IT department might have at most a handful of employees focused on securing their networks, cloud vendors hire thousands of security experts with the sole mission of protecting cloud infrastructure. Similarly, the scale of the public cloud also means that cloud vendors observe attempted attacks across a large customer base and can learn from those observations. Microsoft estimates that daily there are roughly 1.5 million attempts to compromise its systems from which it can learn and further strengthen its security posture.<sup>2</sup>

The rise of the cloud has benefited American enterprises and the consumers they serve tremendously. Robust competition among cloud vendors has created ecosystems of innovation and new opportunities for businesses to optimize their IT needs. While it is appropriate for the FTC to evaluate whether this important industry segment is working well, we believe that the

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<sup>2</sup> *Securing the cloud*, MICROSOFT, <https://news.microsoft.com/stories/cloud-security/>.

FTC will find that the cloud computing segment is highly competitive, with vendors at all levels investing heavily to offer the best range of services that users demand.

## **II. BACKGROUND**

“Cloud providers” host and manage software services and underlying infrastructure and handle maintenance, including service upgrades and security patching. Fundamentally, cloud services allow businesses and developers to focus on building app functionality without expending resources to manage servers and infrastructure required to do so. Cloud providers handle setup, capacity planning, and server management.

Cloud computing services are typically divided into three broad, not entirely distinct, categories: Infrastructure-as-a-Service (“IaaS”), Platform-as-a-Service (“PaaS”), and Software-as-a-Service (“SaaS”). Infrastructure as a service (IaaS) is a type of cloud computing service that offers essential compute, storage, and networking resources on demand, with customers determining and provisioning any other resources they need. Platform as a service (PaaS) is a more complete development and deployment environment in the cloud, with resources that enable customers to deliver everything from simple cloud-based apps to sophisticated, cloud-enabled enterprise applications. Like IaaS, PaaS includes infrastructure—servers, storage, and networking—but also middleware, development tools, business intelligence (“BI”) services, database management systems, and more. PaaS is designed to support the complete web application lifecycle: building, testing, deploying, managing, and updating. SaaS is a method for delivering applications as a service over the internet on demand, often on a subscription basis. The lines between these service categories continue to blur as customers pick and choose from the best solutions available in order to accomplish their specific development goals.

“Public cloud” describes computing services offered by third-party providers over the internet, available to anyone who wants to purchase and use them. All hardware, software, and supporting infrastructure are owned and managed by the cloud provider. This is the most common type of cloud computing deployment. In a “private cloud,” services and infrastructure are exclusively maintained on a private network by a single business or organization. Some companies pay third-party service providers to host their private cloud. A “hybrid cloud” combines public and on-premises infrastructure, including private clouds, allowing data and applications to be shared between them. A “multi-cloud” configuration refers to the use of multiple cloud computing services from more than one cloud provider for the same type of IT solutions or workloads. While most hybrid cloud deployments are multi-cloud, not all multi-cloud deployments are hybrid cloud, because a business might use separate public clouds to manage different workloads. Alternatively, businesses can run their own computing resources in “on-premises” systems, purchasing, managing, and maintaining their own servers and computing infrastructure.

Microsoft is a global provider of cloud computing services for businesses through its “Azure” cloud platform. “Azure” offers hardware and software components and functionalities for both private and public cloud deployments, providing customers with a broad range of IaaS and PaaS services, from datacenters around the world.

Microsoft Azure users have access to over 200 services, broadly including:

- “AI and Machine Learning” services, which enable developers to create their own applications with artificial intelligence capabilities.
- “Analytics” services such as SQL Data Warehouse, HDInsight, Data Lake Analytics, Azure Databricks, and other services, which enable customers to gather, store, process, analyze, and visualize data.
- “Compute” services, which enable customers to access compute capacity and scale on demand.
- Secure, enterprise-grade and fully managed “database” services.
- “Identity” services, which enable customers to manage user identities and provide access to protection against advanced threats across devices, data, apps, and infrastructure.
- “Security” services, which protect enterprises from advanced threats across hybrid cloud workloads.
- “Storage” services, which provide secure, scalable cloud storage for data, apps, and workloads.
- Other categories of services such as “Containers,” “Internet of Things,” “Media,” “Networking,” and “Web.”

“Open source” software is software with source code made available for anyone to copy, share, inspect, modify, and enhance, in contrast with “proprietary” software that is exclusively controlled by the organization that created and owns the software. Azure allows developers to customize and run applications using open source software.

“Containers” virtualize a host operating system and isolate an application’s dependencies from other containers running on the same machine. Containers allow applications to run consistently across different cloud environments without being affected by changes in the underlying infrastructure.

### **III. FOUNDATIONAL INDUSTRY DYNAMICS**

Cloud service providers compete vigorously on the breadth of services they offer, the quality of the developer environment, and the flexibility, scalability, security, and performance that they offer, among other factors. Customers choose to use cloud solutions based on what works best for what they are building or deploying. Application developers want to build their solutions on cloud offerings that have the best tools, including the most popular and powerful third-party solutions. As a result, cloud infrastructure providers both offer their own cloud solutions as well as facilitate those managed by third-party developers.

Cloud computing attracts customers by allowing them to scale IT resources elastically. Cloud computing services are provided self-service and on-demand so that vast amounts of computing resources can be provisioned instantly, giving businesses more flexibility. Cloud providers compete on how responsive they are to customers' immediate demands (among other things), delivering the right IT resources and best solutions as determined by the customer. Open-source solutions such as Linux, OpenStack, and Kubernetes have experienced remarkable growth in the cloud. As of 2020, Linux was the most popular operating system on Azure, and Ubuntu-based workloads are among the fastest growing in the public cloud.<sup>3</sup> Today, 90 percent of public cloud workloads run on Linux, as opposed to proprietary operating systems like Windows Server.<sup>4</sup>

Cloud providers also compete on the policies, technologies, and controls they implement to strengthen cybersecurity and help protect customer data, apps, and infrastructure from threats. Cloud computing simplifies data backup, disaster recovery, and business continuity by mirroring data at redundant sites on the cloud provider's network. Cloud services providers also assist customers with national, regional, and industry-specific compliance requirements governing the collection and use of data. Customers demand the ability to freely access and control their data, and require assurance that their cloud services provider is managing their data in satisfaction of all applicable privacy laws and standards.

As the FTC examines the competitive dynamics in this category, we expect the FTC's analysis will confirm three features of the cloud computing industry:

#### **A. Cloud Computing is Highly Dynamic and Competitive**

The market for cloud computing continues to grow, attracting customers to create new services in the cloud as well as to move parts of existing on-premises IT stacks to the cloud. Cloud growth exceeds all other IT markets, representing 10% of total IT spending.<sup>5</sup> Gartner has projected global cloud revenue would increase from \$403.8 billion in 2021 to over \$716 billion

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<sup>3</sup> Chris Pietschmann, *Linux is Most Used OS in Microsoft Azure – over 50 percent of VM cores*, BUILD5NINES (May 11, 2020), <https://build5nines.com/linux-is-most-used-os-in-microsoft-azure-over-50-percent-fo-vm-cores/>; *Ubuntu on Azure*, MICROSOFT, <https://azure.microsoft.com/en-us/solutions/linux-on-azure/ubuntu/#overview>.

<sup>4</sup> Gartner estimates that over 95% of new digital workloads by 2025 will be deployed on cloud native platforms. See Katie Costello & Meghan Rimol, *Gartner Forecasts Worldwide Public Cloud End-User Spending to Grow 23% in 2021*, GARTNER (Apr. 21, 2021), <https://www.gartner.com/en/newsroom/press-releases/2021-04-21-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-grow-23-percent-in-2021>; see also *Why Linux runs 90 percent of the public cloud workload*, CBTNUGGETS (Aug. 10, 2018), <https://www.cbtnuggets.com/blog/certifications/open-source/why-linux-runs-90-percent-of-the-public-cloud-workload>; Nick Galov, *111+ Linux Statistics and Facts – Linux Rocks!*, WEBTRIBUNAL, (May 20, 2023), <https://hostingtribunal.com/blog/linux-statistics/#gref>.

<sup>5</sup> Meghan Rimol, *Gartner Forecasts Worldwide IT Spending to Grow 5.1% in 2022*, GARTNER (Jan. 18, 2022), <https://www.gartner.com/en/newsroom/press-releases/2022-01-18-gartner-forecasts-worldwide-it-spending-to-grow-five-point-1-percent-in-2022>.

in 2024.<sup>6</sup> IDC has reported that combined spending on shared cloud servers would total \$385 billion in 2021, with a CAGR of over 21%, reaching \$809 billion in 2025.<sup>7</sup>

There is no shortage of actual and potential cloud providers who compete aggressively for the increasing number of customer opportunities on cost, security, capabilities, and other factors. Hyperscalers continue to innovate and grow. AWS, Azure, and GCP are leaders in the provision of public cloud services in the US.<sup>8</sup> However, with the diverse and rapidly changing demands of cloud customers, other clouds compete to meet the needs of customers across a wide range of industries and use-cases.

AWS has always been the market share leader in cloud computing services. When Microsoft entered the cloud business in 2010, AWS had an estimated 80-90 percent share of the infrastructure layer.<sup>9</sup> AWS continues to hold the highest share of sales, with an estimated 32% share across IaaS, PaaS, and hosted private cloud in 2023,<sup>10</sup> which Gartner estimates to be two times the share of its nearest competitor.<sup>11</sup> AWS is focused on being a broad-based provider of IT services, ranging from cloud-native and edge to ERP and mission-critical workloads.<sup>12</sup> AWS has outperformed the market in financial commitments enterprises make to use the platform and continues to grow rapidly year over year.

Google Cloud is also making significant investments in its enterprise go-to-market capabilities, winning business in its core competencies of data and analytics, while gaining ground with traditional enterprise workloads such as SAP.<sup>13</sup> Having grown an estimated 63.7% percent between 2020 and 2021 alone,<sup>14</sup> infrastructure leaders generally expect GCP to be at the top of

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<sup>6</sup> Naomi Eide, *Cloud market potential unbound as 'cloud-first' becomes ubiquitous*, CIO DIVE (Nov. 11, 2021), <https://www.ciodive.com/news/cloud-market-growth-gartner/609932/>.

<sup>7</sup> Michael Shirer, *IDC Forecasts Worldwide "Whole Cloud" Spending to Reach \$1.3 Trillion by 2025*, BUSINESS WIRE, (Sept. 14, 2021), <https://www.businesswire.com/news/home/20210914005759/en/IDC-Forecasts-Worldwide-Whole-Cloud-Spending-to-Reach-1.3-Trillion-by-2025>.

<sup>8</sup> Raj Bala et al., *Magic Quadrant for Infrastructure and Platform Services*, GARTNER (Oct. 19, 2022), <https://www.gartner.com/doc/reprints?id=1-29B7RDWN&ct=220304&st=sb>.

<sup>9</sup> *Tanks in the cloud*, THE ECONOMIST (Dec. 29, 2010), <https://www.economist.com/international/2010/12/29/tanks-in-the-cloud>.

<sup>10</sup> *Q1 Cloud Spending Grows by Over \$10 Billion from 2022; the Big Three Account for 65% of the Total*, SYNERGY RSCH GRP (Apr. 27, 2023), <https://www.srgresearch.com/articles/q1-cloud-spending-grows-by-over-10-billion-from-2022-the-big-three-account-for-65-of-the-total>.

<sup>11</sup> Bala et al., *supra* note 8.

<sup>12</sup> *Id.*

<sup>13</sup> *Id.*; see also *SAP and Google Cloud Expand Partnership to Build the Future of Open Data and AI for Enterprises*, SAP (May 11, 2023), <https://news.sap.com/2023/05/sap-google-cloud-expanded-partnership-open-data-ai-enterprises/>.

<sup>14</sup> Meghan Rimol, *Gartner Says Worldwide IaaS Public Cloud Services Market Grew 41.4% in 2021*, GARTNER (June 2, 2022), <https://www.gartner.com/en/newsroom/press-releases/2022-06-02-gartner-says-worldwide-iaas-public-cloud-services-market-grew-41-percent-in-2021>.

strategic cloud provider selection in the next few years.<sup>15</sup> GCP has closed gaps with AWS and Azure in cloud capabilities and provides what Gartner considers to be the most fully featured Kubernetes<sup>16</sup> service.<sup>17</sup> Containerization continues to accelerate, with more than 50% of developers in 2019 reporting that they either used containers or intended to within a year.<sup>18</sup>

Oracle is aggressively growing its infrastructure cloud business, competing for customers worldwide.<sup>19</sup> In 2020, Oracle added more capabilities on a percentage basis than any other provider in the market. Oracle's CEO recently noted "that [Oracle's] growth rates are higher than hyperscale competitors [and Oracle's] growth rates are increasing as we get bigger." The company's Chairman and Chief Technology Officer stated that "Oracle is much less expensive than [AWS], in part because we're faster. We are talking to some of the biggest brands that are on Amazon and some of them are going to be moving very soon."<sup>20</sup>

IBM also offers a full stack of public cloud services with a focus on enabling hybrid cloud deployments and AI services.<sup>21</sup> The company has focused on regulated workloads and industry-specific cloud services and has a long history of serving clients with complex challenges using high-touch approaches that these customers value. IBM also owns Red Hat which offers one of the most popular Linux operating systems used in the cloud, enabling IBM to offer services not just in its own datacenters but on all major infrastructure providers.

Large, well-resourced companies with incentives to develop an at-scale cloud for their own use may also enter the market by opening up their private cloud to deliver services to others. Indeed, Amazon initially entered the space this way, leveraging its own datacenters that powered Amazon's retail marketplace to introduce AWS. Facebook, Salesforce, and Apple also run significant datacenters that power their popular offerings, similarly positioning them to enter the IaaS and PaaS segments.

## **B. Customers Make Sophisticated Choices**

Customers come to cloud providers with diverse needs. There is no standard customer use case or set of services that customers demand from cloud providers. Many factors contribute

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<sup>15</sup> Bala et al., *supra* note 8.

<sup>16</sup> Kubernetes, developed by Google in 2014, is a system designed to automate application deployments, scaling, and management. See, e.g., *What is Kubernetes?*, GOOGLE, <https://cloud.google.com/learn/what-is-kubernetes>.

<sup>17</sup> Rimol, *supra* note 14.

<sup>18</sup> Sandy Carielli, *Container Adoption Is On The Rise: How Can Security Keep Up?*, FORRESTER (July 24, 2020), <https://www.forrester.com/blogs/container-adoption-is-on-the-rise-how-can-security-keep-up/>.

<sup>19</sup> Paul Gillin, *Strong cloud growth propels Oracle results*, SILICON ANGLE (Sept. 12, 2022), <https://siliconangle.com/2022/09/12/strong-cloud-growth-propels-oracle-results/>.

<sup>20</sup> Wade Tyler Millward, *Oracle's Ellison: OCI Is Nabbing The 'Most Famous' AWS Brands*, CRN (Sept. 12, 2022), <https://www.crn.com/news/cloud/oracle-cto-larry-ellison-oci-is-nabbing-the-most-famous-aws-brands>.

<sup>21</sup> *IBM Cloud Products*, IBM, <https://www.ibm.com/cloud/products>; *Why IBM*, IBM, <https://www.ibm.com/cloud/why-ibm/>; *Hybrid cloud solutions*, IBM, <https://www.ibm.com/hybrid-cloud>.

to a company's choice of cloud products or providers, including the company's size, the industry the company operates in, the complexity of their cloud needs, the company's stage of cloud adoption, and the company's overall approach to technology adoption. As a result, most cloud providers offer a consumption-based model that allows customers to use whatever mix of services meets their needs.

Customers choose to use cloud providers to help them increase efficiency and performance while reducing the expense of running onsite datacenters. Onsite datacenters require resource intensive IT management, including hardware setup and software patching, and they take time to deploy and expand. But cloud computing services run on a worldwide network of secure datacenters running the fastest and most efficient technologies. Cloud native technologies provide significant advantages over legacy operating systems and applications designed to run on-premises, providing customers with additional flexibility and choice. This reduces network latency for applications and provides greater economies of scale. Cloud computing also eliminates the high fixed costs of software and hardware that historically limited customers' ability to move workloads between IT environments, allowing customers to add capacity very quickly. Cloud customers pay only for what they use, providing them with more flexibility as to what workloads they want to move. Thus, using cloud services helps customers better optimize their IT costs.

Customers do not need to move their computing workloads to a public cloud and are under no pressure to migrate all their computing needs to the cloud at one time. Cloud customers always retain the ability to run solutions on-premises or to develop private cloud solutions rather than using public clouds. Customers will only use public cloud services if they offer more attractive services than are available on-premises or in private cloud solutions. As a result, firms often choose to use both internal and external solutions and shift workloads between them. For example, Walmart developed a private cloud while also using public cloud services from GCP and Microsoft Azure.<sup>22</sup>

When customers decide to migrate some or all of their data onto the cloud, providers compete to show customers the value of their offerings not only for this initial migration, but also for any future workloads. After deciding to move to a cloud services provider, customers do not necessarily continue with that provider for all new work. Rather, customers constantly make choices between cloud providers for where to deploy new projects. For each incremental workload or solution, customers can choose which cloud provider to use, or whether to deploy on-premises or in a private cloud. This recurring competition spurs product innovation, a steady downward pricing trend, and allows customers to choose from a wide range of services provided by both independent vendors and cloud providers.

These customer dynamics are reflected in how cloud vendors offer their services. Cloud vendors have designed their solutions to be modular so that customers can mix and match their

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<sup>22</sup> Antone Gonsalves, *Walmart's multi-cloud strategy cuts millions in IT costs*, TECHTARGET (July 12, 2022) <https://www.techtarget.com/searchcloudcomputing/news/252522631/Walmarts-multi-cloud-strategy-cuts-millions-in-IT-costs>.



favorite solutions across different cloud services providers as needed. Cloud infrastructure providers compete for customer workloads on the portfolios of solutions they offer on their clouds, which includes attracting third parties to make solutions available on their cloud infrastructure. By employing multi-cloud strategies, customers can access the services best-suited to meet their specific needs, while also enhancing resilience in their cloud architecture and strengthening their bargaining position with any given cloud services provider.

Not surprisingly, customers increasingly use multi-cloud strategies. A 2020 IDG survey found that 55% of respondents used multiple public clouds.<sup>23</sup> Flexera's 2022 State of the Cloud Report characterized multi-cloud as "the de facto standard" and reported that "79 percent of respondents said they're incorporating multiple public clouds, and 60 percent report using more than one private cloud—an increase from last year."<sup>24</sup> The trend continued in the 2023 report, with 87% of organizations reporting use of multi-cloud strategies.<sup>25</sup>

Cloud providers enable developers to work with the third-party products and services that the developers choose to use. Cloud customers are typically developers with specialized knowledge and experience in IT procurement. These customers aggressively negotiate agreements for the cloud services they need. They can negotiate contractual guarantees to ensure that any contemplated workload transitions remain an economically viable option. They play competing clouds against each other on an ongoing basis, both for initial migrations to the cloud and new workloads deployed on the cloud, in order to achieve discounts, SLAs, and favorable terms.

Professional services have also developed to help ease the burden on customers considering moving to a particular cloud. Cloud services providers work with a large network of partners, including major consulting firms like Deloitte, Accenture, Cognizant, and Tata Consulting, and more focused providers of cloud migration services, like Cloudamize, Corent Technology, Device 41, Rackware, and many others, to help customers assess whether and how to run workloads in the cloud.<sup>26</sup>

Given this wide range of consumer choice and specialized customer expertise, cloud customers are able to determine and choose the cloud solutions that work best with whatever they are building or deploying. These customers can choose to design IT solutions that preserve their potential to switch between or away from public clouds. They have the technical expertise to

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<sup>23</sup> IDG, IDG CLOUD COMPUTING SURVEY 6 (2020), [https://cdn2.hubspot.net/hubfs/1624046/2020%20Cloud%20Computing%20executive%20summary\\_v2.pdf](https://cdn2.hubspot.net/hubfs/1624046/2020%20Cloud%20Computing%20executive%20summary_v2.pdf).

<sup>24</sup> FLEXERA, STATE OF THE CLOUD REPORT 16, 17 (2022), <https://m3comva1.frb.io/uploads/docs/Flexera-State-of-the-Cloud-Report-2022.pdf>.

<sup>25</sup> FLEXERA, STATE OF THE CLOUD REPORT (2023), <https://info.flexera.com/CM-REPORT-State-of-the-Cloud>.

<sup>26</sup> See, e.g., *Cloud Solutions*, COGNIZANT, <https://www.cognizant.com/us/en/services/cloud-enablement-services/cloud-consulting>; *Cloud Services*, DELOITTE, <https://www2.deloitte.com/us/en/pages/consulting/solutions/cloud-consulting-services.html>; *Cloud services*, ACCENTURE, <https://www.accenture.com/us-en/cloud/services-index>.

assess trade-offs involved in optimizing for migration versus more cloud-specific integration. Customers may choose to restrict their use of cloud services to lower-level infrastructure services to allow themselves to move workloads from one cloud environment to another more easily. Or customers may rely on third-party solutions, which can also make switching between clouds easier. For any particular workload, customers are well-equipped to decide for themselves whether to trade portability in exchange for speed, convenience, and the advanced technology that the cloud provides.

### **C. Security is the Foundation of the Cloud**

Security capabilities and offerings are fundamental to cloud service providers' value proposition. As more customers' data and mission-critical systems migrate to the cloud, providers have had to continue to advance their cybersecurity approaches and develop increasingly sophisticated defense strategies. Hyperscale cloud providers are able to leverage centralized security management and expertise to deploy comprehensive protections. Hyperscale clouds offer unique and significant security benefits due to their differentiated infrastructure, investments, and degree of threat visibility.

Microsoft offers customers robust infrastructure services including advanced data and operational security measures. Microsoft invests billions to pioneer best practices and innovate new security features. Security protocols are deeply ingrained at every layer and niche of the cloud, covering infrastructure security, resiliency, continuity planning, and distributed denial-of-service ("DDoS") defenses and mitigations.<sup>27</sup> Moreover, Microsoft provides customers with access to top data security talent, a team of over 3,500 global cybersecurity experts who work collaboratively to safeguard customers' business assets and data within Azure.<sup>28</sup>

Microsoft's global presence and substantial investments in cyber threat intelligence and AI/ML empower it to better defend customers against ever-evolving threats. The company's extensive product portfolio, broad client base, and managed infrastructure gives it enhanced visibility into the latest trends in cyber threats, allowing for more frequent, timely, and accurate threat identification, resulting in more proactive mitigation.<sup>29</sup> For example, Microsoft's Defender for Cloud allows automatic detection and blocking of malware at first sight. It can detect and block malware that has never been seen before. The product does not simply rely

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<sup>27</sup> *Azure platform resiliency*, MICROSOFT (June 9, 2022), <https://learn.microsoft.com/en-us/dotnet/architecture/cloud-native/infrastructure-resiliency-azure>; *Business continuity management in Azure*, MICROSOFT (Nov. 9, 2022), <https://learn.microsoft.com/en-us/azure/reliability/business-continuity-management-program>; *Microsoft denial-of-service defense strategy*, MICROSOFT (Mar. 2, 2023), <https://learn.microsoft.com/en-us/compliance/assurance/assurance-microsoft-dos-defense-strategy>.

<sup>28</sup> *Strengthen your security posture with Azure*, MICROSOFT, <https://azure.microsoft.com/en-us/explore/security>.

<sup>29</sup> *See Security*, MICROSOFT, <https://www.microsoft.com/en-us/security/business>.

on known threat patterns, but rather integrates prospective threat detection at the code, infrastructure, and runtime levels to make sure that deployed applications are protected.<sup>30</sup>

Microsoft employs a broad spectrum of resiliency tactics that work together to prevent single points of failure and outages. Microsoft's cloud infrastructure operates across multiple data centers spread across different regions, with layered interconnections. Redundancy is ingrained in the fabric of cloud infrastructure, and resiliency is a core principle of the networking layer. Datacenter replication, data mirroring, and other redundancy, failover, and recovery capabilities, used within appropriate geographic boundaries for both platform and customer data are foundational aspects to how Microsoft operates its security services. These measures guarantee the security of customer data as well as its uninterrupted availability.

In addition to ensuring that the cloud is consistently accessible and available for users, Microsoft invests heavily in the integrity and confidentiality of data stored in the cloud. Use of virtualization across the cloud provides resource isolation that prevents bad actors from penetrating the cloud to gain broad access to user data. These protections apply even within organizations—for example, protecting wider business data should one employee's credentials be stolen in a phishing scheme. This architecture of separation is a key security component of the cloud. Logical isolation, encryption, and programmatic controls provide threat protection and mitigation equivalent to that provided by physical isolation alone.<sup>31</sup> Cutting-edge encryption of data at-rest and in-transit create meaningful obstacles to data insecurity.<sup>32</sup>

For on-premises databases, companies are responsible for patch management, vulnerabilities, and security configuration scanning. By contrast, Microsoft and other cloud providers manage a greater share of these security responsibilities through the cloud service model. Microsoft's datacenters employ a wide range of physical protections, including resilient architecture, integrated electronic access control systems, and sophisticated crisis management and continuity plans. In addition to this form of security, cloud providers may also be responsible for network controls, patching, and identity and access controls, undertaking these and other critical security maintenance activities as part of their offered services.

Cybersecurity is by necessity a shared responsibility between cloud providers and users, but a key component of security in the cloud is making sure customers understand the allocation of responsibility. Therefore, Microsoft offers various ways to help customers conduct security due diligence and assess compliance of third-party cloud providers, including offering free access to certification documentation and an independent audit program. Microsoft provides freely available and highly detailed security guidance on separate and shared security responsibilities

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<sup>30</sup> *What is Microsoft Defender for Cloud?*, MICROSOFT (May 21, 2023), <https://learn.microsoft.com/en-us/azure/defender-for-cloud/defender-for-cloud-introduction>.

<sup>31</sup> *Microsoft 365 isolation controls*, MICROSOFT (May 25, 2023), <https://learn.microsoft.com/en-us/compliance/assurance/assurance-microsoft-365-isolation-controls>.

<sup>32</sup> *Encryption*, MICROSOFT (June 14, 2023), <https://learn.microsoft.com/en-us/microsoft-365/compliance/encryption?view=o365-worldwide>.

across major security and data privacy controls frameworks. Controls-level explanations also exist for more than fifteen security and compliance frameworks from various countries, sectors, and international best practices, including ISO 27001, NIST SP 800-53, the Federal Risk and Authorization Management Program (FedRAMP), Payment Card Industry (PCI), Data Security Standard (DSS) 3.2.1, the Center for Internet Security (CIS), and the Azure Security Benchmark.<sup>33</sup>

Microsoft complies with a wide range of security and data privacy requirements. Microsoft is authorized under FedRAMP, a compliance program that provides a standardized approach for assessing, monitoring, and authorizing cloud computing products and services under the Federal Information Security Management Act (FISMA) to accelerate the adoption of secure cloud solutions by federal agencies.<sup>34</sup> Certifications such as FedRAMP help customers better understand how Microsoft's security offerings meet certain baseline requirements, even in instances where Microsoft goes well beyond these requirements to serve unique customer needs and specific industry challenges. Cloud service providers compete on offering the most advanced security protections to customers, and certifications are a key differentiator.

Microsoft also invests in and leads the development of industry-wide standards to help further clarify the allocation of security responsibilities between cloud providers and users. It has partnered with the Cyber Risk Institute in their development of the Cloud Extension, an initiative that identifies roles and responsibilities between firms and cloud security providers to establish a mutually beneficial framework for cybersecurity.<sup>35</sup>

#### **IV. IMPLICATIONS**

Cloud computing has revolutionized the IT industry. Cloud computing provides flexible, scalable, and secure access to leading technologies and computing power for enterprises of all sizes. Start-ups, small- and mid-sized businesses, and enterprises have all turned to cloud computing as a way to diversify or expand their IT infrastructure. Undertakings of all types—from information technology to manufacturing to entertainment, financial services, health care, hospitality, retail services, and more—have seen the promise of the cloud for growing and expanding their business. Access to cloud computing has driven increased innovation, efficiency, and productivity. Competition in the cloud industry is dynamic and growing, and the number of new service offerings and providers continues to increase. Advances in AI and machine learning tools and projects promises to accelerate these trends.

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<sup>33</sup> See generally *Regulatory Compliance*, in *Azure Policy Samples*, MICROSOFT (Apr. 18, 2023), <https://learn.microsoft.com/en-us/azure/governance/policy/samples/>.

<sup>34</sup> *Federal Risk and Authorization Management program (FedRAMP)*, MICROSOFT (Mar. 15, 2023), <https://learn.microsoft.com/en-us/compliance/regulatory/offering-fedramp>.

<sup>35</sup> *CRI Announces Completion of Cloud Profile Extension*, CRI, <https://cyberriskinstitute.org/cri-announces-completion-of-cloud-profile-extension/>.

Customers considering the cloud have a wide range of choices. Cloud offerings have to compete with other alternatives—customers only move workloads to the cloud if cloud vendors can offer improved functionality at lower cost. Within the cloud segment, robust competition exists between cloud providers, as customers demand the best quality and portfolio of services for their particular needs for any particular workload deployment. Customers often decide workload by workload how to organize their IT stack and may use multiple cloud offerings from different vendors to address different projects, further minimizing dependence on any given service provider.

These market dynamics strongly suggest that market forces are driving fierce competition on price, quality, and innovation dimensions. Fundamentally, the engine that drives competition in the cloud is customers' demand for fast, secure, scalable solutions that can address users' diverse IT needs and that can attract world-class developers to create innovative applications in the cloud environment. Microsoft and other vendors invest billions of dollars competing to grow and expand these cloud solutions for customers. Regulations that impinge on cloud vendors' incentives to innovate, grow, or expand their offerings run the risk of impacting the quality of these solutions and the pace of innovation, and ultimately disadvantaging American companies on the global stage.

That is not to say that there is not a meaningful role for regulation. As Microsoft leadership recently stated, Microsoft believes that industry- or governmental regulation of certain elements of AI are urgently needed.<sup>36</sup> But the safety and ethical implications of AI are independent issues that do not stem from the cloud. For the broader industry, so long as cloud providers continue to compete on cost, performance, and security for the ever-growing number of opportunities, regulators should carefully avoid any intervention that might disturb the competitive offerings that have promoted the explosive innovation and growth attributable to the cloud.

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<sup>36</sup> See Brad Smith, *How do we best govern AI?*, MICROSOFT (May 25, 2023), <https://blogs.microsoft.com/on-the-issues/2023/05/25/how-do-we-best-govern-ai/>.